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# QUALITY ASSURANCE PROJECT PLAN (QAPjP) FOR THE SITE CHARACTERIZATION OF THE 903 DRUM STORAGE AREA (IHSS 112), 903 LIP AREA (IHSS 155), AND AMERICIUM ZONE

**RF/RMRS-98-261**

• Environmental Restoration •
Rocky Flats Environmental Technology Site

**September 1, 1998**
**Revision 0**

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**Rocky Mountain Remediation Services, L.L.C.**

September 1, 1998
Document Control No: RF/RMRS-98-261
Revision No. 0

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Radiological Engineering [signature] Date 9/2/98

Document Classification
Review Waiver Per
Classification Office
CEX-010-98

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## 1.0 INTRODUCTION

This QAPjP pertains to the 903 Pad, Lip Area, and Americium Zone (903 Pad or Project) work activities with the Rocky Mountain Remediation Services (RMRS) document, *Quality Assurance Program Description* (QAPD), RMRS-QAPD-001. . A matrix of QAPjP sections and SOPs that satisfy 10 CFR 830.120 and the RFP [Reference 7.5] (Exhibit B, Section 2.5) requirements are given in Table 6.7-1, "Matrix of Subcontractor 903 Pad Performance Bases vs. Quality Requirements."

## 2.0 PURPOSE

This QAPjP defines the work requirements, procedures and quality controls necessary for performing Insitu Gamma Spectroscopy measurements.

## 3.0 SCOPE

This QAPjP is relevant and applicable to all subcontractor staff performing Project work activities.

## 4.0 RESPONSIBILITIES

The Project Manager (PM), also the Surface Soil Investigation Lead, responsibilities are:

- Ensuring that the Project tasks integrate quality assurance requirements with work activities
- Overall Project surface soil investigation
- Coordinating data collection, HPGe measurements and surface soil sampling, and analytical samples
- Performing linear regression analyses of the data

The Gamma Spectrometry Specialist I responsibilities are:

- Data interpretation pertaining to all aspects of gamma spectrometry
- Evaluation of the spectral analysis software
- Proper operation and maintenance of gamma spectrometry instrumentation

The Gamma Spectrometry Specialist II responsibilities are:

- Collection of gamma spectrometry data
- Proper operation and maintenance of gamma spectrometry instrumentation

The Health and Safety Specialist responsibilities are:

- Ensuring staff compliance with the requirements of the Site Health and Safety Practices (HSP) Manual and the task-specific HASP
- Performing an Activity Hazard Analysis (AHA) for each activity or task required for the performance of the Subcontractor work scope that is not included in the RMRS task-specific HASP

The Technical Specialist/Senior Scientist responsibilities are:

- Providing peer review of all Project activities
- Assisting RMRS with Project meetings, communication needs, and document management and control

The RMRS and Subcontractor Technical Representatives shall evaluate measurement data for accuracy.

## 5.0 DEFINITIONS

ACCURACY: The degree of agreement between measured concentration values and the true or known values.

ASSESSMENT/VERIFICATION: The act of reviewing, inspecting, testing, checking, conducting surveillance's, auditing, or otherwise determining whether items, processes, or services meet specified requirements

COMPARABILITY: A qualitative measure of the confidence with which a set of data from one assay system can be compared to another from a second system.

COMPLETENESS: A quantitative measure expressed as a percentage of valid or acceptable data obtained from a measurement system.

DATA QUALITY OBJECTIVE (DQO): A qualitative and quantitative statement that describes the quality and quantity of data necessary to achieve the overall level of uncertainty that a decision maker is willing to accept in results derived from the data.

DOCUMENT: Any original or copied written, recorded, or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results

ELECTRONIC RECORD: Information determined to be a record that is stored as a file within a computer in a form that only a computer can process or read.

GRADED APPROACH – The process of basing the level of application of managerial controls applied to an item or work according to the intended use of the results and the degree of confidence needed in the quality of the results.

HOLD POINT: A designated stopping place during or following a specific activity at which inspection or examination is required before further work can be performed.

NON-CONFORMANCE: A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate. Examples of non-conformance include: physical defects, test failures, incorrect or inadequate documentation, and deviation from prescribed procedures.

PRECISION: A quantitative measure of the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter

RECORD - All original books, papers, maps, photo-negatives, forms, machine readable materials, or other documentary materials, regardless of physical form or characteristics, made or received

SENSITIVITY: The MDC shall be at least 1/10 of 10 pCi/g of $^{241}$Am (established to for future Actinide Migration Panel use which is less than RFCA TIER II action levels).

STANDARD OPERATING PROCEDURE (SOP): Written requirements and methods necessary to ensure the quality of data meets the objectives dictated by its intended use.

RANDOM UNCERTAINTY: A statistical term referring to uncertainties that include counting errors and those related to a non-uniform distribution, e.g., contamination.

SYSTEMATIC ERRORS: A statistical term referring to uncertainties that arise from equipment calibration and positioning.

TOTAL UNCERTAINTY: The consummation of random and systematic uncertainties that are propagated to arrive at a total uncertainty at a given confidence level, i.e., 95%. Uncertainties will be obtained from the measurements or estimated by the *in situ* technical specialist.

VALIDATION A technical review of the project's data that defines the limitations of usability based on specific quality control protocols and end use of the data.

VERIFICATION: The process of confirming that required components and formats of the data package have been received from the subcontractor.

## 6.0 PROGRAM REQUIREMENTS/IMPLEMENTATION X PARTS I, II AND III

### Part I: Management

### 6.1 Program Management

It is the commitment of the subcontractor to perform Project work in a manner that is consistent with the RMRS QAPD. The Subcontractor staff shall implement the Project program using data quality objectives (DQO) to ensure that the "graded approach" process of achieving quality is embedded in work processes. See Section 6.4, "Data Quality Objectives."

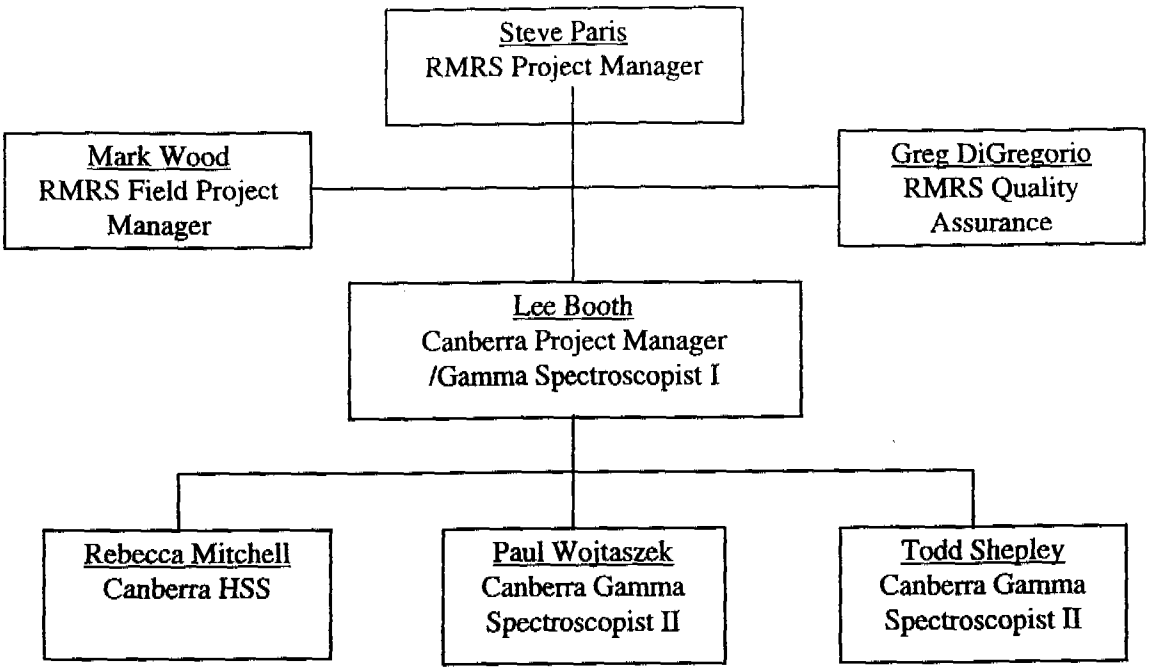
### 6.2 Program Organization

The Subcontractor Project Manager (PM) is accountable to the RMRS Quality Engineer for the conduct of Project operations that affect quality. All Project staff according to the requirements of this QAPjP shall accomplish quality performance.

Periodic internal surveillance's are conducted to ensure corrective actions effectiveness and continuous quality improvement.

All staff is tasked with using the graded approach to implement and evaluate Project operations that affect quality. The graded approach is integrated with proceduralized methods and instructions and RMRS procedures

**CHART 6.2-1**
**PROJECT ORGANIZATION CHART**




## 6.3 Personnel Training and Qualification

Transcripts and resumes document education and experience; RMRS Human Resources or the subcontractor maintains them.

All personnel shall receive the required indoctrination and training specific to the tasks each individual will be performing at the Site. Personnel qualifications shall comply with the quality assurance requirements listed above. Site supervisors and workers shall have the minimum training requirements listed in Table 6.3-1 prior to the start of Project activities defined in the scope of work.

RMRS will provide the Site-specific training to personnel at the Site as provided in Table 6.3-2. Personnel shall coordinate with RMRS for obtaining Site-specific training.

Objective evidence of staff competency and their maintenance of competency is accomplished in accordance with the RMRS procedures for establishing personnel records and records maintenance in accordance to 3-21000-ADM-02.02, Rev. 1, Personnel Position Description.

Site-specific and project-specific training records are managed by the RMRS CTR and the Training, Scheduling, and Records (TSR) Database.

**TABLE 6.3-1**
**MINIMUM TRAINING REQUIREMENTS**

| Training | Requirements |
|---|---|
| OSHA 40-Hour | OSHA 1926.65 |
| OSHA 8-Hour Refresher | OSHA 1926.65 |
| OSHA 8-Hour Supervisor | OSHA 1926.65 (Supervisors Only) |
| Medical Monitoring | Subcontractor Medical Monitoring Program shall be approved by RMRS |
| Hazard Communication | Subcontractor Hazard Communication Program shall be approved by RMRS |
| Hearing Conservation | Subcontractor Hearing Conservation Program shall be approved by RMRS |

**TABLE 6.3-2**
**SITE-SPECIFIC TRAINING REQUIREMENTS**

| Training |
|---|
| Respirator Computer Based Training |
| Respirator Qualitative Fit Test |
| Radiation Worker Level II |
| Health and Safety Specialist Training |

## 6.4 Data Quality Objectives (DQO) for the 903 Pad Project

Classify 903 Pad surface soils as exceeding or not exceeding Tier 1-soil action levels according to *in situ* measurement data by measuring soil concentrations of Am-241, U-235 and U-238; classification shall have a 95% confidence for false negatives and false positives.

Prior to taking field measurements, ensure the factory calibration of the Subcontractor ISOCS Gamma Spectroscopy System(s) uses the specified combination of calculation and source measurement techniques as described in RF/RMRS-98-262, *ISOCS Gamma Spectroscopy System Input Parameter.*

- Initially, a QC efficiency measurement will be performed to verify system calibration.
- A standard reference material (SRM) mounted in a small container will be placed one meter from the detector and an acquisition performed, i.e., the factory calibration will include an efficiency calibration for a point source at one meter.
- The In Situ Object Counting System (ISOCS) point source at one-meter efficiency. The results should yield the correct SRM value within the measurement and source uncertainties.

Set control limits for the background check, calibration check, field control measurements, duplicates provided for each measurement in accordance with Reference 7.3, *Evaluation of Radiochemical Data Usability,* and Sections 6.4.1 through 6.4.5 below.

**Note:** In order to provide sufficient margin for detection of the three nuclides to be measured (an MDC of ≤ 1/10 of the proposed Actinide Migration Panel acceptance level of 10 pCi/g), by *in situ* methods have been set at 1 pCi/g Am-241, 0.5 pCi/g U-235, and 5.0 pCi/g U-238.

6.4.1 Background Check:

- The counting uncertainty, total propagated uncertainty (TPU), and minimal detectable concentration (MDC) uncertainty must be reported at the same level of confidence, e.g., ± 2s at 95%. ( NOTE - Lee, include the equation for the TPU's provided below).

- Background count time must be equal to or greater than sample count time.

- On a daily basis, the ISOCS system will be tested for background response by placing the system at a known background (no contaminants) location and an acquisition performed. The results will be plotted on a control chart. The control limits hall be established via control charting, using a minimum of 20 sequentially measured data points. An exceedance of ± 3 standard deviations on the control chart, mandates stop work and corrective action

6.4.2 Field Control Measurements:

Field control areas will be established by regressing insitu results with fixed laboratory results (based on composite samples). These control measurements shall be assured through the duplicate error ratio equations and a test statistics of ± 1.96for pass fail criteria. RMRS will determine up to 5-field control measurement locations, and subsequently, 1 of these will be reported per measurement set. The PM should view measured results for naturally occurring radionuclides to verify that measured results are within expected ranges.

$$\frac{S\text{-}D}{\sqrt{TPU^2_{S+}TPU^2_D}}$$

6.4.3 Duplicates:

A field duplicate serves as a QC monitoring tool for the analytical method. (See Reference 7.3, pp. 29-30)

- For each measurement set of 20 in situ measurements, a QC duplicate shall be performed. The duplicate will be evaluated per the DER equation above. If the duplicate fails, work will be stopped and corrective actions implemented for the measurement set.

6.4.4 Check Source Measurements:

These shall be performed at the start of each measurement set to monitor system stability, alignment and response. Spectrum response must be within ± 20% relative to the efficiencies, and within 10% of the applicable energy specifications provided by the sensors manufacturer.

- A working material check source containing Am-241, Co-60 and Cs-137, or similar multiline nuclides, will be mounted in a reproducible position on the detector and an acquisition performed.

- The check source activity will be logged and the system status assigned a "pass" or "fail" status based on comparison with the tolerances listed above plotted on control charts.

- Should a QC check fail, the PM shall review all data collected between the failing standard and the last passing standard during that shift to determine the validity of the data. Traceability to check source standards (certificates) should be available at the field office.

6.4.5 Quality Assurance

For each measurement set of 20 in situ measurements, the system will be positioned at a selected Control Area and an acquisition performed. The measured concentrations will be compared to values established by soil sampling. Results should be consistent within the range of measurement errors.

Detector distance will be recorded for each measurement.

Subcontractor measurements of global positioning, temperature, pressure, and humidity will be recorded and compared with on-site measurements as a control check.

Density will be determined using a National Institute of Standards Technology (NIST) traceable mass balance.

Evaluation of 903 Pad measurement data for usability per RF/RMRS 98-200 and the required parameters are as follows:

- All data (100%) shall be validated per quality controls as defined in the QAPjP.
- Accuracy: Accuracy's shall be assessed per tolerances set in Section 6.4.3. In situ results will be correlated to laboratory results of discrete soil samples via linear regression.
- Precision: Precision shall be demonstrated by performing duplicate counts of soil samples at random locations at a frequency not to exceed once per measurement set.
- Sensitivity: Sensitivity limits (i.e., MDCs) for the three radionuclides of interest, shall be ≤ 10% of the applicable action levels are specified in Section 6.4.2. The MDC calculation is given in procedure RF/RMRS-98-267, *Data Review*.
- Completeness: A goal of 90% has been set for this Project. See Section 5.4, "Completeness."
- Comparability: Comparability will be attained through the consistent use of the Operating Procedure developed for the use of the HPGe, and attainment of the specified signatures.

- Representativeness: Representativeness is accomplished by obtaining an adequate number of samples from appropriate spatial locations within the medium of interest. The actual sample types and quantities will be compared with those stated in the SAP . Deviation from the required and actual parameters will be evaluated for impact to decisions.
- Total Uncertainty: A total propagated uncertainty will be calculated for each measurement which included Random Uncertainties and Systematic Errors.

## 6.5 Quality Improvement

Quality improvement shall be realized in accordance with DQOs 6.4.2, 6.4.3 and 6.4.4 above. To identify, track and correct deficiencies, procedure RMRS-03.01, *Corrective Action* and 1-65-ADM-15.01, *Control of Non-conforming Items,* shall be used. Also, see Section 6.12, "Assessments."

## 6.6 Documents and Records

### 6.6.1 Document Control

Document Control for electronic and hard copy records, including quality records, is performed in accordance with RMRS DC-06.01, *Document Control Program,* and RMRS-DC-05.01, *Preparation and Control of RMRS Documents.*

### 6.6.2 Software for Electronic Records

- Subcontractor shall declare which software package(s) will be used to analyze Site measurements and shall provide documentation of assumptions, calculations, and unique terms incorporated into, or used by the software.
- Subcontractor will supply evidence of software verification and validation that shall be approved by the PM prior to first use.
- Any changes to the software package(s) must be approved by the PM and RMRS CTR prior to analysis of Site measurements.
- Subcontractor shall maintain a program that addresses measures taken to ensure computer programs used to generate data are validated, verified, and documented for both vendor-supplied and in-house software packages. This program shall incorporate the computer hardware and software requirements from ANSI/ANQC E4-1994.

### 6.6.3 Data Management and Control

The management and control of data generated by Project activities is performed in accordance with applicable radiation work permits (RWP), the Project Sampling and Analysis Plan (SAP), and RM-06.02, *Records Identification, Generation and Transmittals.*

6.6.4 Data Package Requirements

The general data package deliverable requirements for the Project are provided in Table 6.6-1. The process for assembly of the data package and its elements is performed in accordance with *Electronic Data Deliverables Build Procedure*, which complies with specifications the Subcontractor SOW.

**Note:** Preliminary data, which consists only of isotopic results by location, requires packaging within 24 hours of the measurement..

**TABLE 6.6-1**
**DATA PACKAGE DELIVERABLES**

| Deliverable Section Number | Deliverable Section Title |
|---|---|
| 1 | Cover Page |
| 2 | Narrative |
| 3 | Sample and QC Sample Results Summary |
| 4 | Instrument Calibration Summary |
| 5 | Counting Raw Data Summary |
| 6 | Electronic Data Deliverable |
| 7 | Data Review Checklist |

## 6.7 Work Processes and Standard Operating Procedures

6.7.1 Procedures, Work Instructions and Protocols

Work shall be performed under controlled conditions using written, approved standard operating procedures (SOP) or other documents as defined in Table 6.7-1. The Project SOPs include procedures for the characterization of High Purity Germanium (HPGe) detectors, calibration of HPGe detectors, routine HPGe measurements, collection of surface soil samples, and decontamination of sampling equipment.

Current SOPs shall be available at workstations, as appropriate. A complete set of SOPs shall be made available to RFETS oversight personnel performing an on-site evaluation.

6.7.2 Staff QA Briefing and Pre-Evolution Meetings

A Project QA briefing will be given during the pre-evolution briefing. The QA briefing will cover the requirements stated in this QAPjP and attendance will be documented by using the pre-evolution attendance roster.

## TABLE 6.7-1
## MATRIX OF SUBCONTRACTOR 903 PAD PERFORMANCE BASES VS. RFP QUALITY REQUIREMENTS(1)

| 10 CFR 830.120 & RFP* Exhibit B, Section 2.5 REQUIREMENTS | 903 Pad Performance Basis of this QAPjP by Reference |
|---|---|
| Policy and Commitments | Policy Statement, p. iv, and Section 6.1 "Program Management"<br>OPS-DIR-001, "Safety and Environmental Stewardship Directive" |
| Management and Organization | Sections: 1.0 "Introduction," and 6.2 "Program Organization" |
| Functional Responsibilities | Section 4.0 "Responsibilities" |
| SOPs | Section 6.4, "Data Quality Objectives (DQO) for Measurement Data," |
| Personnel Training & Qualification | Section 6.3, "Personnel Training and Qualification"<br>RMRS-QA-02.01, *RMRS Qualification and Certification of Quality Assurance Personnel,*<br>1-S52-T & Q-TR-004, RFETS Training Requirements |
| DQO | Section 6.4, "Data Quality Objectives (DQO) for Measurement Data," P903-009, *Data Review.* |
| Quality Improvement | Section 6.5 "Quality Improvement," RMRS-QA-03.01, *Corrective Action,*<br>1-65-ADM-15.01, *Control of Non-conforming Items.* |
| Documents and Records | Section 6.6, "Documents and Records,"<br>RMRS-DC-05.01, *Document Control,* RM-06.02, *Records Identification, Generation and Transmittals,* QA-05.01, *Preparation and Control of RMRS Documents,* RF/RMRS-98-266, *EDD (Electronic Data Deliverables) Build Procedure.* |
| Work Processes<br><br>**LEE Modify the Document Control Numbers** | Section 6.7, "Work Processes and Standard Operating Procedures,"<br>OPS-DIR-001, *Safety and Environmental Stewardship Directive,*<br>D903-001, *ISOCS Verification and Validation Measurements Document,*<br>D903-002, *Detector Characterization Document,*<br>RF/RMRS-98-261, *Quality Assurance Project Plan (QAPjP) for the Site Characterization of the 903 Drum Storage Area (IHSS 112), 903 Lip Area (IHSS 155), and Americium Zone,*<br>RF/RMRS-98-267, *Data Review,*<br>RF/RMRS-98-266, *EDD (Electronic Data Deliverables) Build Procedure,*<br>RF/RMRS-98-262, *ISOCS Program Input Parameter System,*<br>RF/RMRS-98-268, *ISOCS Gamma Spectroscopy Routine Operations Procedure,*<br>GT.08, *Surface Soil Sampling,*<br>Manufacturer's Specifications for the Ground Positioning System (GPS) Operation |
| Design | Section 6.8, "Design of Work Processes" |
| Procurement | Section 6.9, "Procurement" |
| Inspection and Acceptance Testing | Section 6.10, "Inspection and Acceptance Testing" |
| Measuring and Test Equipment | Section 6.10.1, "Inspection and Acceptance Testing" |
| Assessments | Section 6.11, "Assessments," RMRS-QA-09.01, *"Management Assessments,"*<br>RMRS-QA-10.02, *RMRS Conduct of Surveillance's,* and RMRS QA-10.01, *Independent Assessments.* |

(1) The RFP, *Determination of Radionuclides by In Situ HPGe Gamma Spectroscopy, Rev. 1, April 1998,* states on page A-2: The Subcontractor shall prepare a QAPjP that incorporates all quality requirements in 10 CFR 830.120;" on page B-2, Section 2.5: "The QAPjP shall describe the policy, organization, functional responsibilities, and quality assurance requirements and methods (SOPs) necessary to assure that the quality of data meets the objectives dictated by its intended use."

* Categories specified by the RFP *and* 10 CFR 830.120 are underscored.

- QC Requirements for Routine HPGe Measurements
  - Measurement Set
  - Measurement Identification
  - Measurement Location Control
  - Daily Source Checks
  - Background Measurements
  - Duplicate Measurements

### 6.7 Design of Work Processes

Design is performed in accordance with the procedures listed in Table 6.7-1. These procedures incorporate requirements, design bases, and methods for accomplishing the following design criteria.

- Design work shall include incorporation of applicable requirements and design bases, identification and control of design interfaces, and verification or validation of the adequacy of design products by individuals or groups other than those who performed the work. The verification and validation is completed before approval and implementation of the design.

- The design control processes are established for the control of design inputs, outputs, verifications, reviews, changes, modifications, and configuration change control. Software V&V shall specifically include the following parameters:
  - ⇒ actinide depth distribution in soil profile
  - ⇒ averaging depth
  - ⇒ soil density
  - ⇒ air density
  - ⇒ detector distance
  - ⇒ temperature
  - ⇒ and humidity

- Design control requirements for procured design and engineering services are incorporated into procurement specifications. See Section 6.9 below.

### 6.8 Procurement

Any subcontractor procurement of items must meet the Site procurement requirements, reviewed by RMRS Project Controls and Quality Assurance, and be approved by the RMRS CTR.

### 6.9 Inspection and Acceptance Testing

Acceptance criteria and any hold points are clearly defined in the controlling documentation (Table 6.7-1), and will be based on manufacturer's specifications.

### 6.10 Measuring and Test Equipment (MT&E)

Measurement and test equipment (M&TE) will be accepted or rejected based on characterization and calibration information and pre-established tolerances (Section 6.4), including unique identification, traceability, accuracy, resolution, measurement ranges, and

acceptance/rejection criteria. Calibration standards shall be traceable to nationally recognized, or industry standards with certificates (or copies) filed at the field office

### 6.11 Assessments

- Management assessments shall be performed and documented in accordance with RMRS-QA-09.01, *Management Assessments.*

- Independent assessments shall be performed and documented in accordance with RMRS-QA-10.02, *RMRS Conduct of Surveillance's* and RMRS-QA-10.01, *Independent Assessments.*

## 7.0 REFERENCES

7.1 *Energy,* "Nuclear Safety Management: Quality Assurance Requirements," US Nuclear Regulatory Commission, Title 10 Code of Federal Regulations Part 830.120, Office of the Registrar, National Archives and Records Administration, Washington, DC.

7.2 *Quality Assurance*, DOE Order 5700.6C, US Department of Energy, Washington, DC.

7.3 *Evaluation of Radiochemical Data Usability,* ES/ER/MS-5, Lockheed Martin, Environmental Restoration Program, April 1997.

7.4 *Quality Assurance Program Description,* RMRS-QAPD-001, Rocky Mountain Remediation Services LLC, Revision 1.

7.5 *Request for Proposal for Determination of Radionuclides by In Situ High Purity Germanium Gamma Spectroscopy*, Rocky Mountain Remediation Services LLC, Rev. 1, April 1998.